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(54) **FLUID DISPENSERS WITH INCREASED MECHANICAL ADVANTAGE**

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B67D 7/06	(2010.01)
A47K 5/12	(2006.01)
B05B 11/00	(2006.01)

(52) **U.S. Cl.**

CPC ***A47K 5/1207*** (2013.01); ***B05B 11/3056*** (2013.01)

(58) **Field of Classification Search**

CPC A47K 5/1207; A47K 5/12; A47K 5/1202; A47K 5/1204; B05B 11/3056
USPC 222/180–181.3, 321.8, 309, 477, 505
See application file for complete search history.

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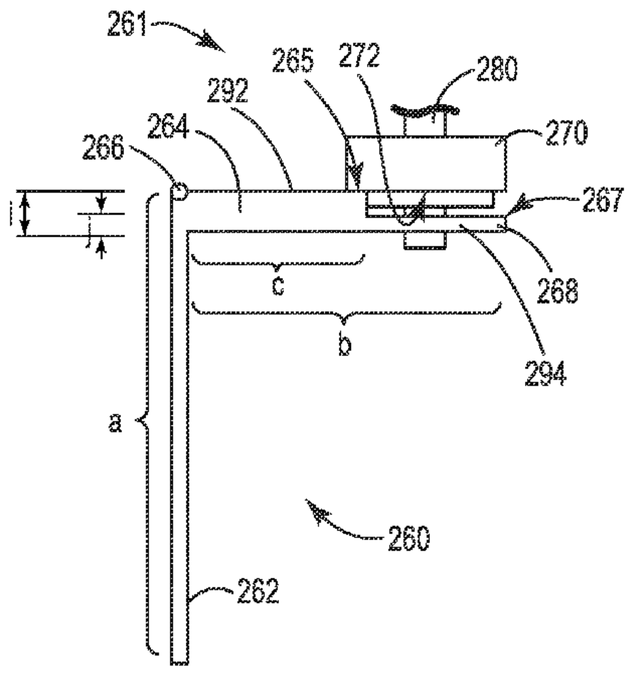
(57) **ABSTRACT**

A fluid dispenser includes a dispense mechanism that provides for increased mechanical advantage. The dispense mechanism includes a lever member and an actuator. The lever member includes a first lever section that receives application of an input force and a second lever section that applies an output force to the actuator. The lever member and/or the actuator are configured to provide at least two contact points between the actuator and the second lever section during the course of a dispensing stroke such that the mechanical advantage provided at a first one of the at least two contact points is greater than the mechanical advantage provided at a second one of the at least two contact points.

10 Claims, 7 Drawing Sheets



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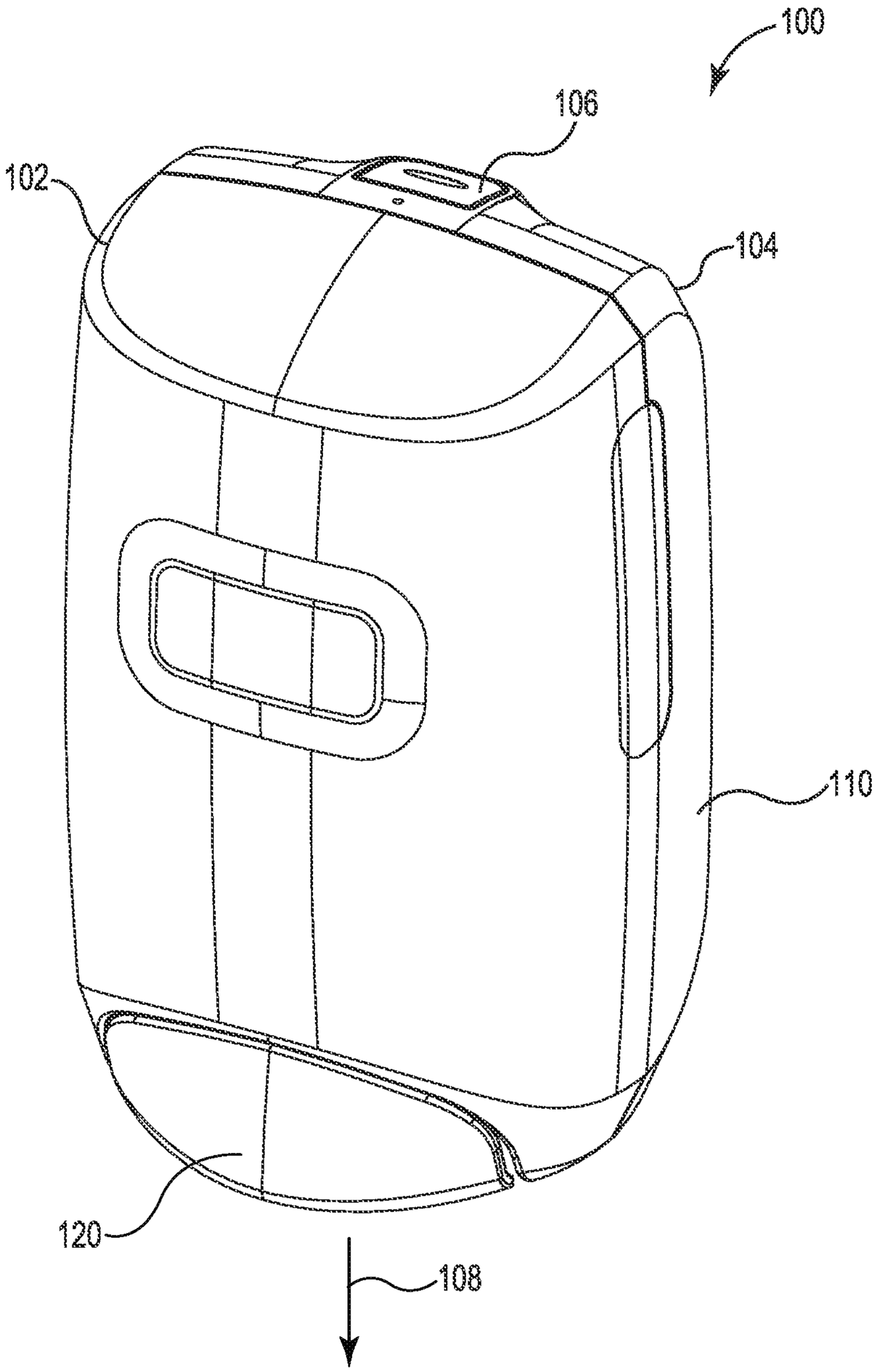


Fig. 1A

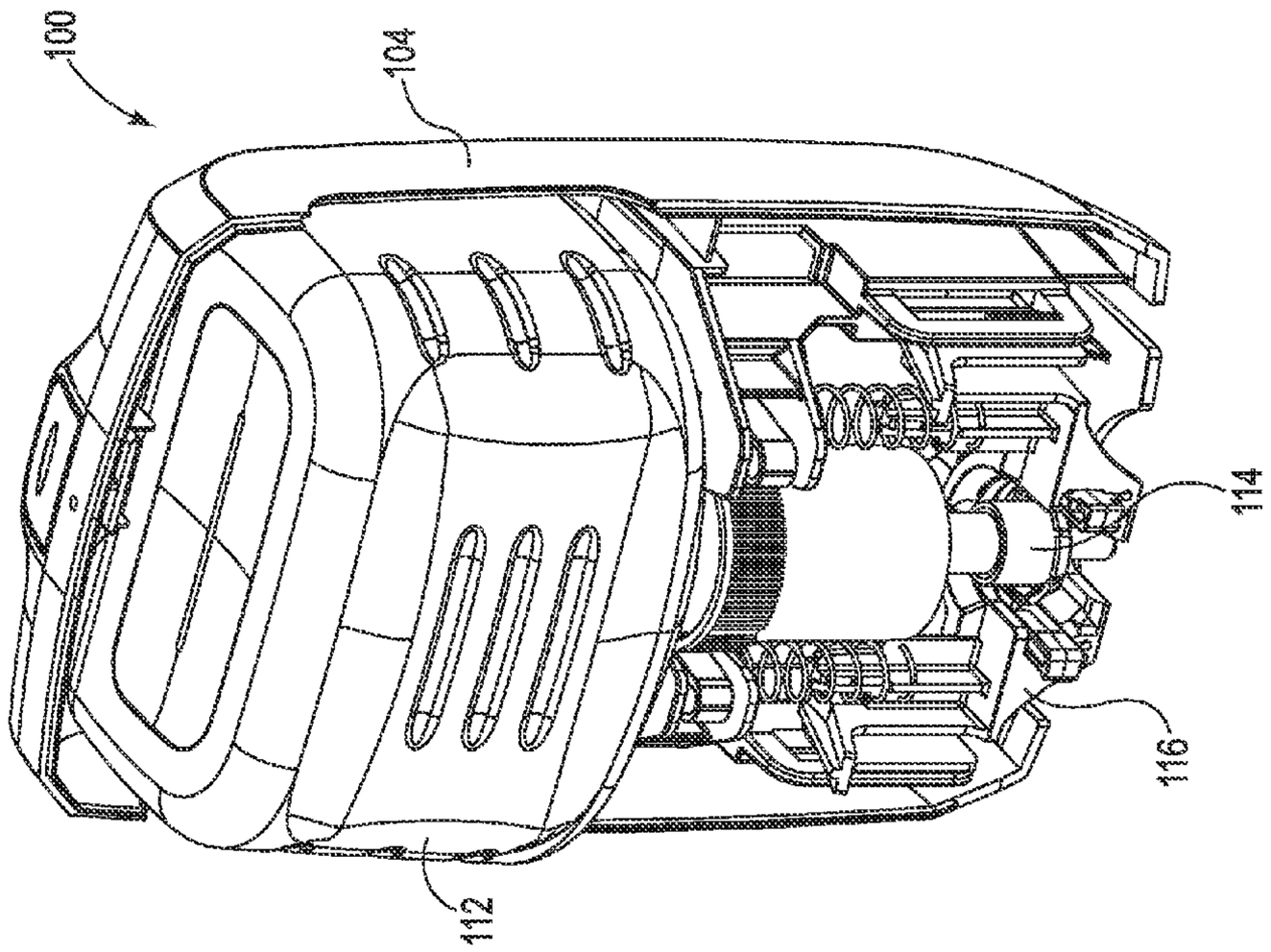


Fig. 1C

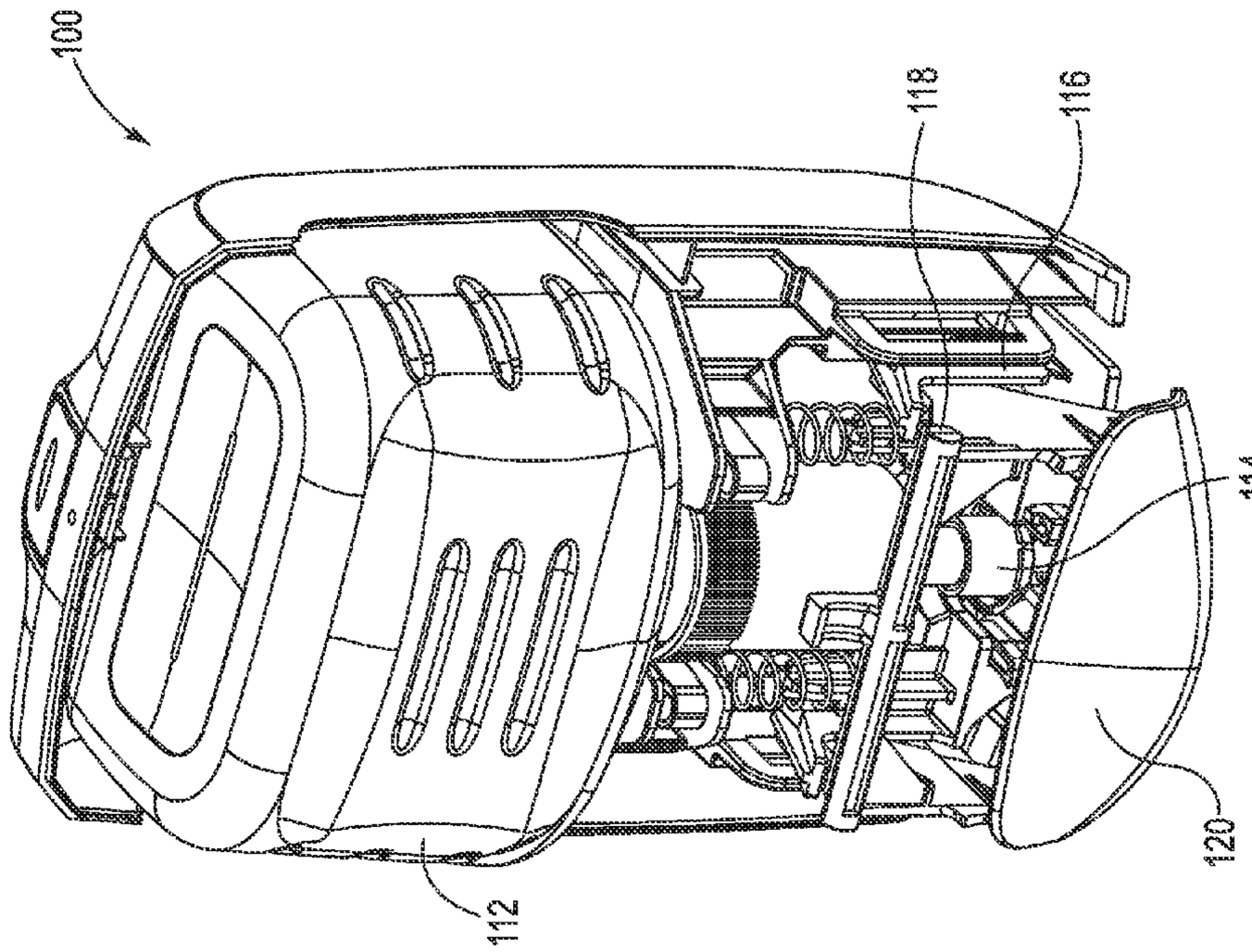


Fig. 1B

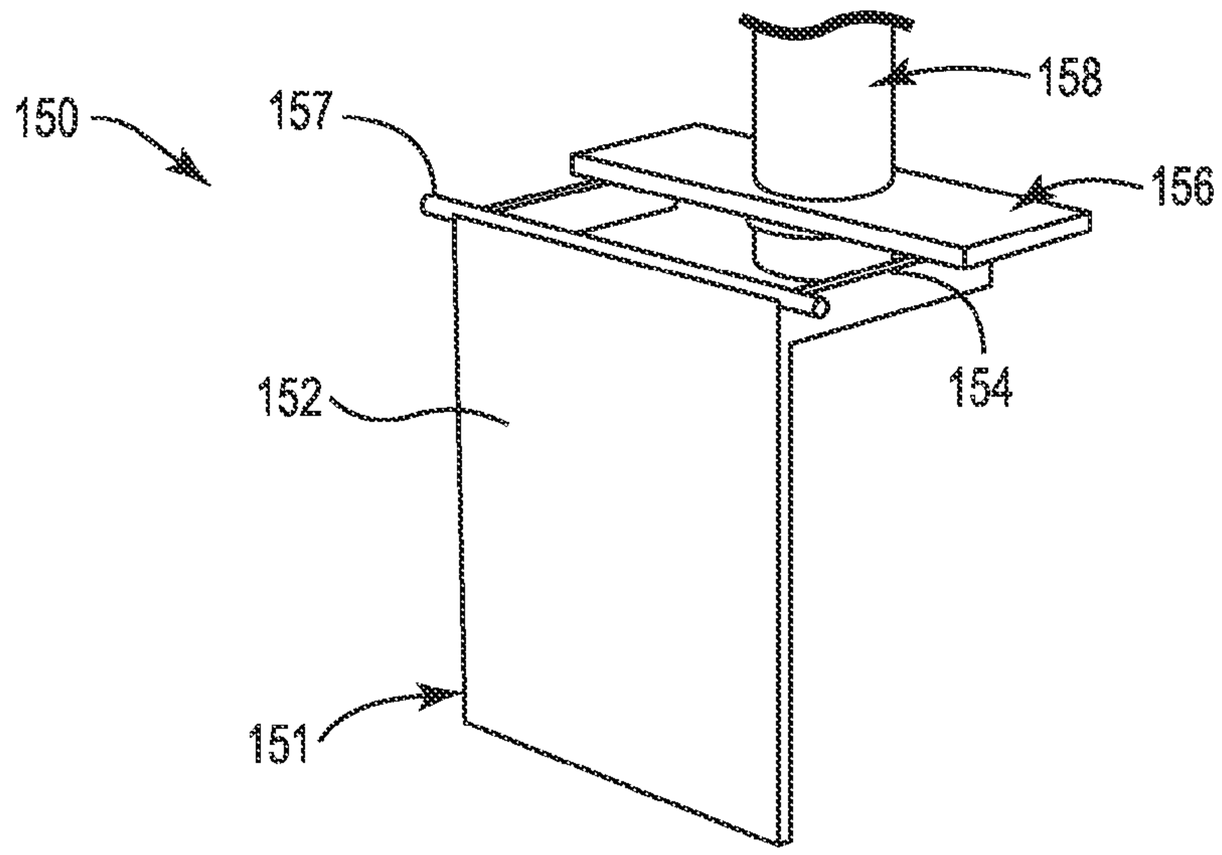


Fig. 2A
(PRIOR ART)

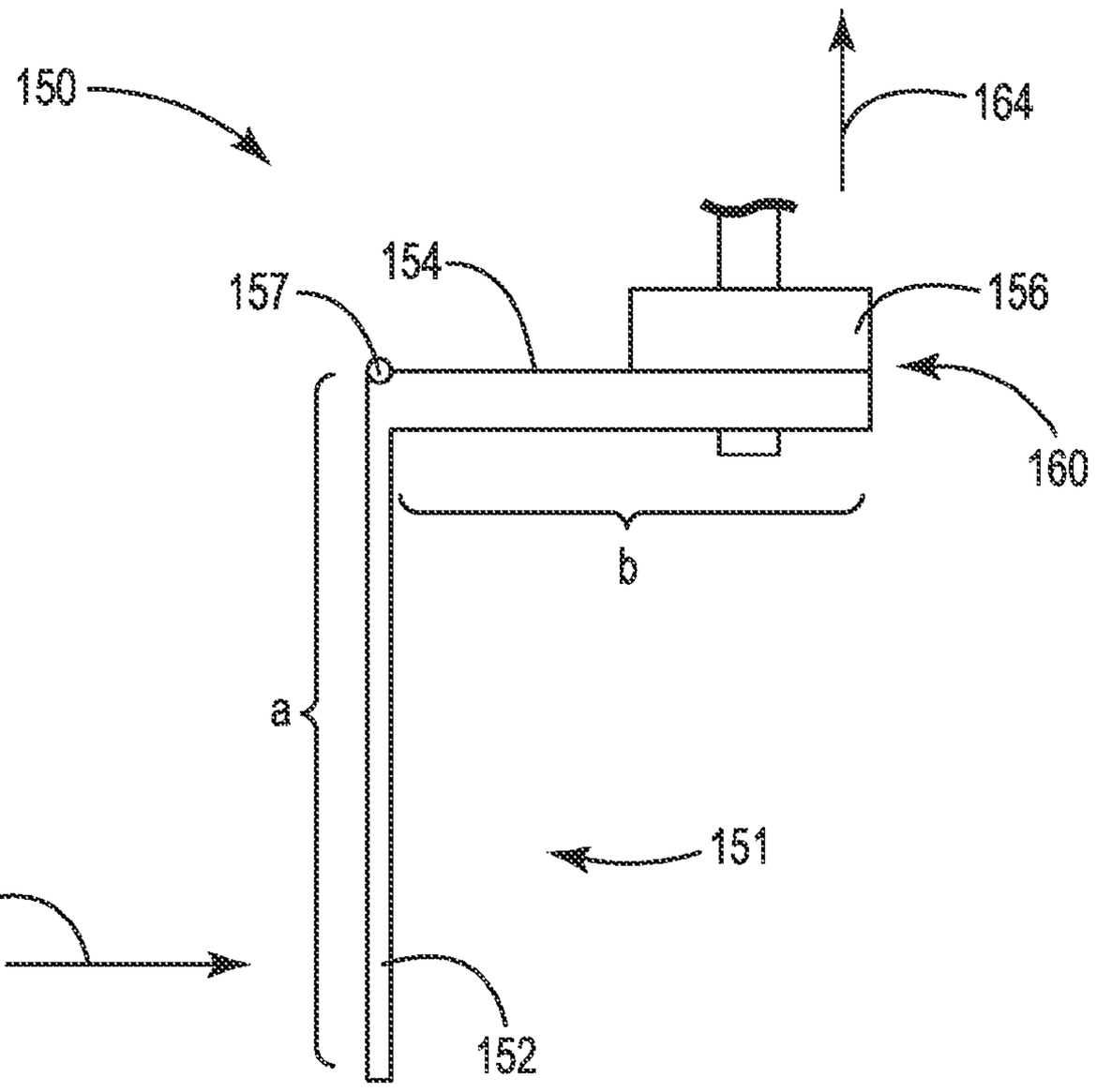


Fig. 2B
(PRIOR ART)

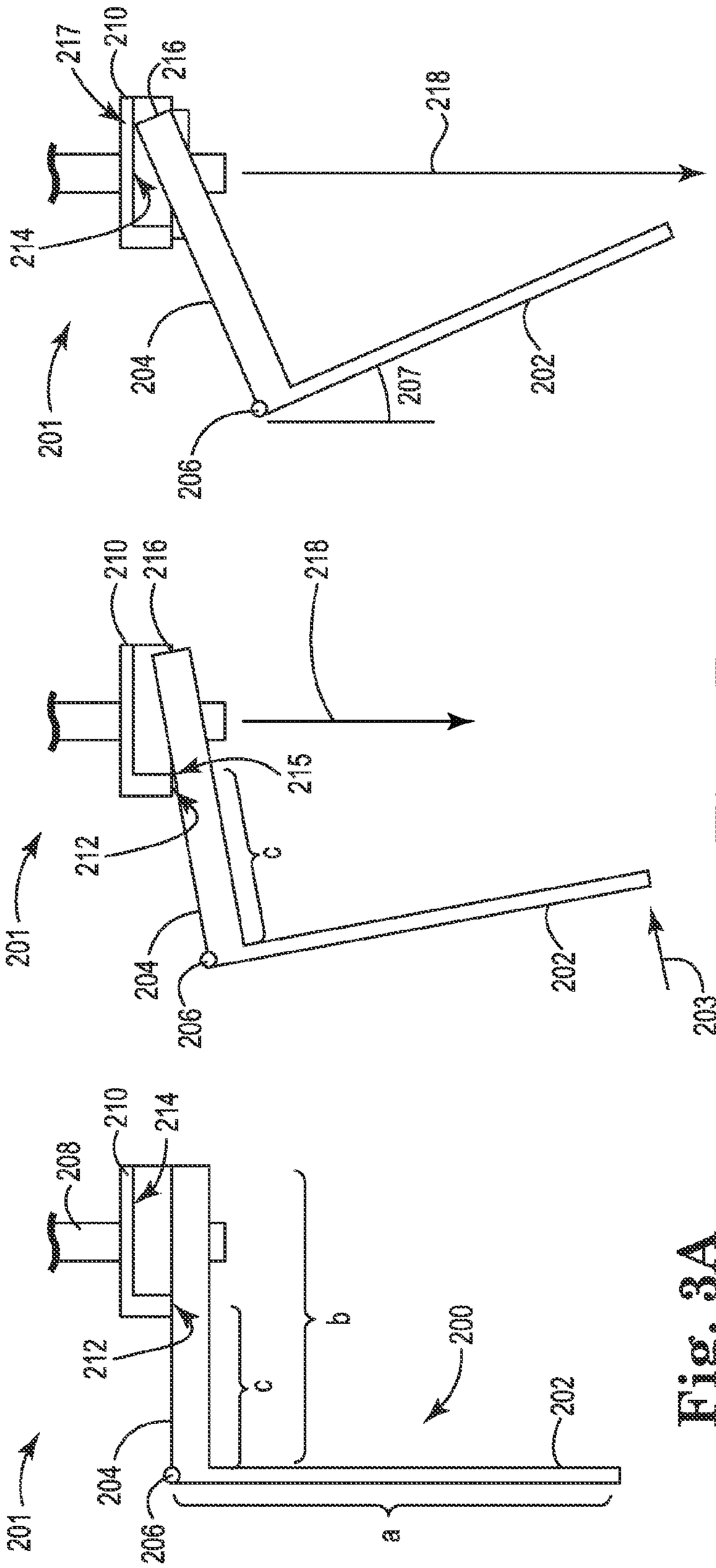


Fig. 3C

Fig. 3B

Fig. 3A

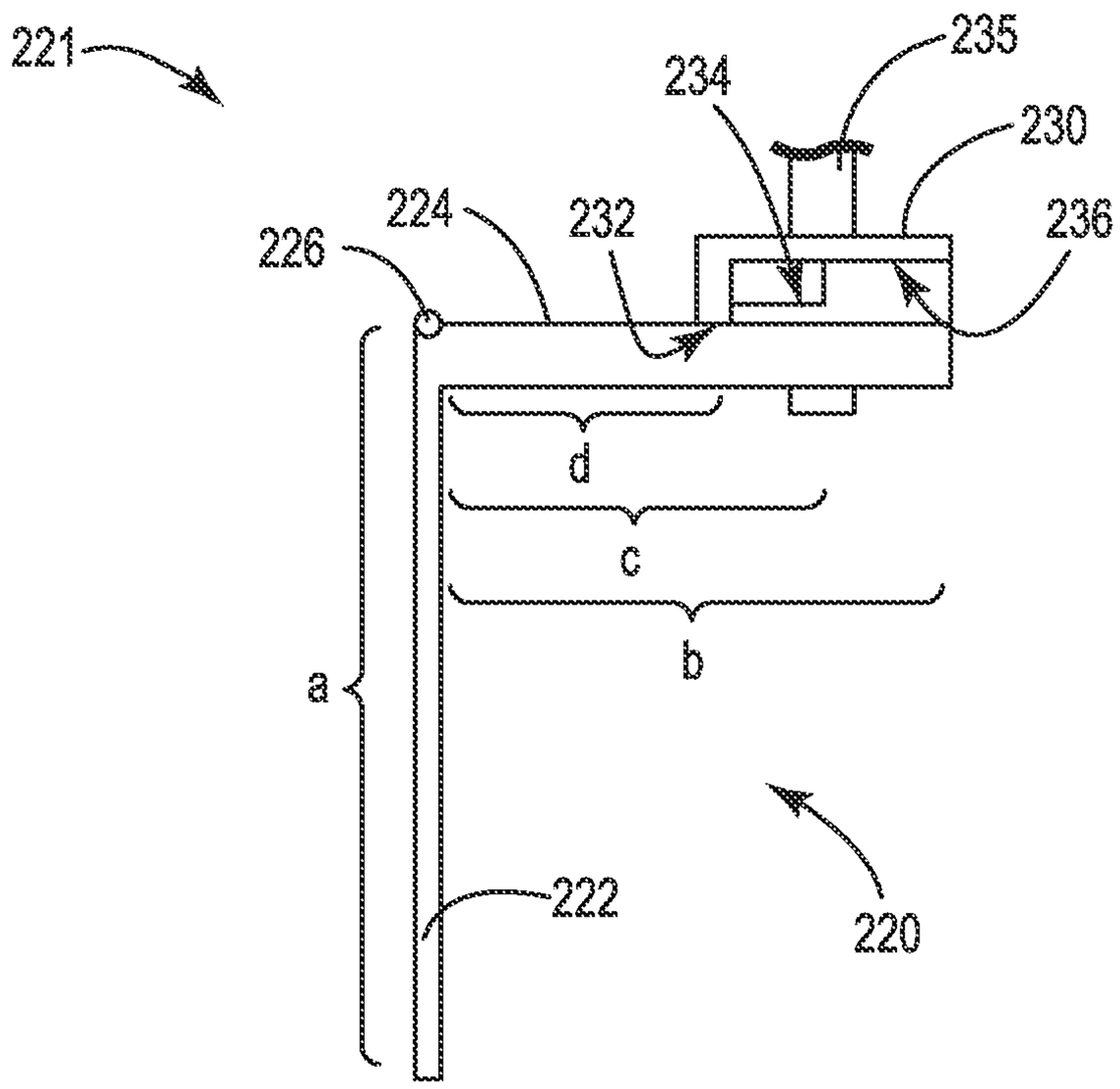
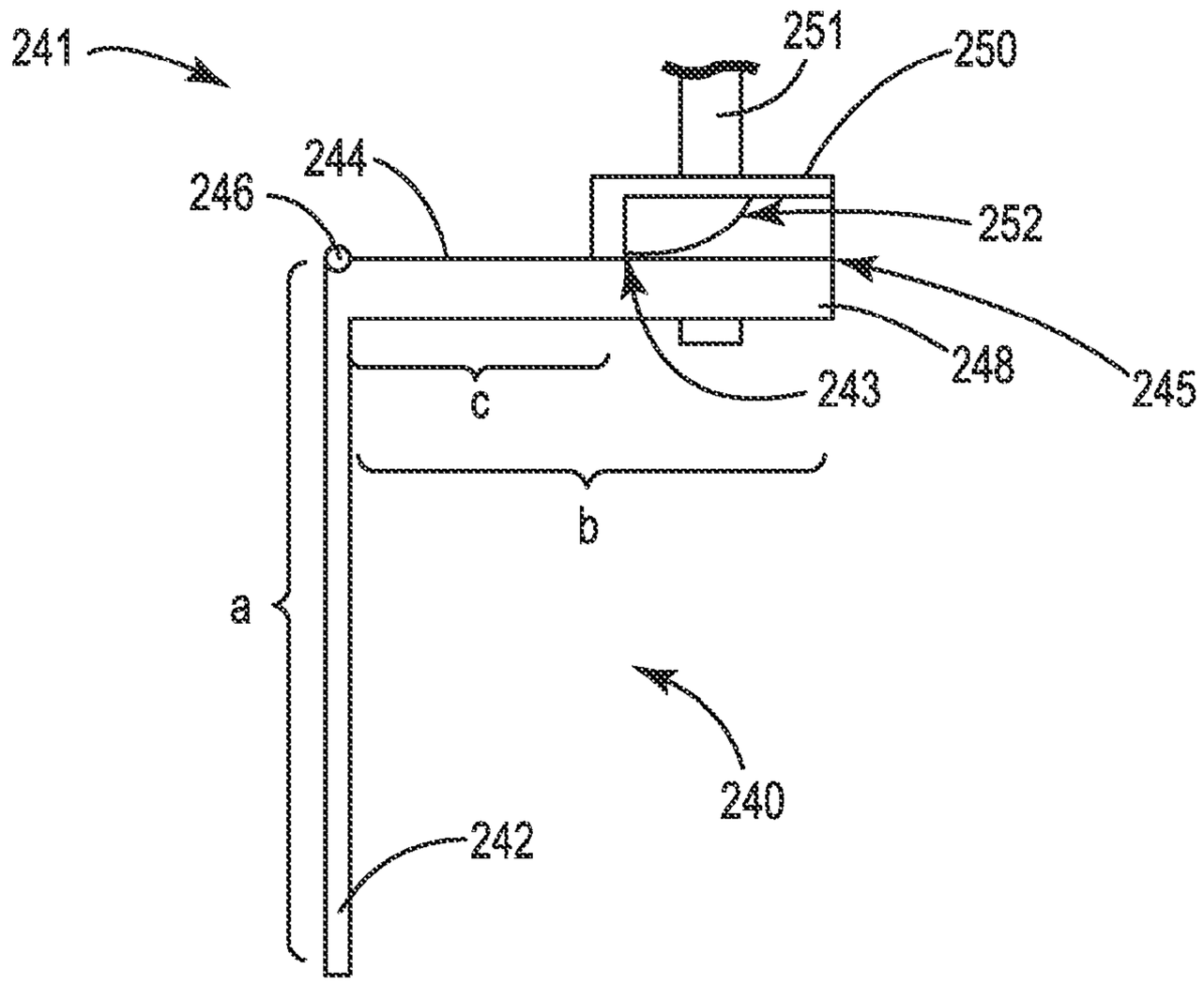


Fig. 4


241
251
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252
245
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243
c
b
a
240
242

Fig. 5A

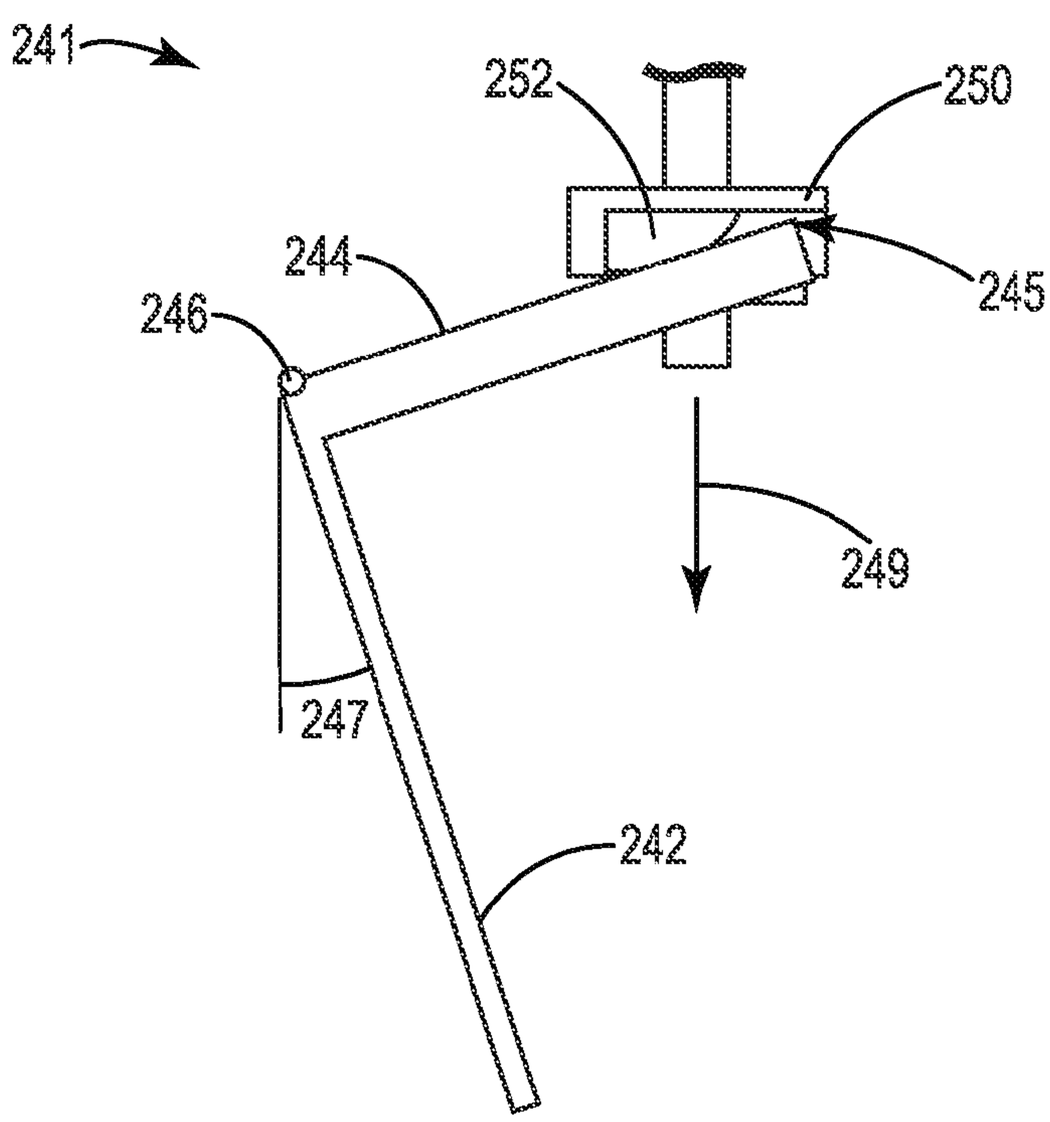
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Fig. 5B

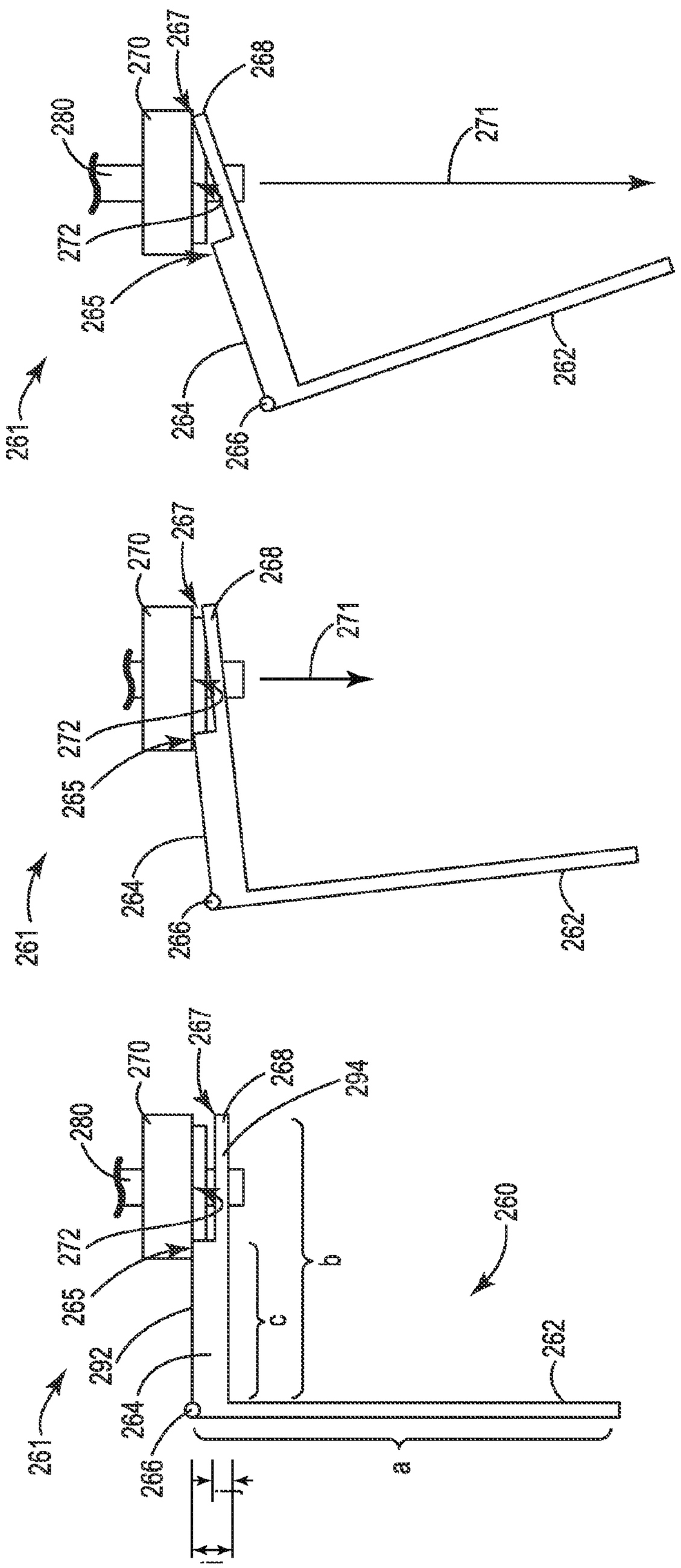

Fig. 6C

Fig. 6B

Fig. 6A

FLUID DISPENSERS WITH INCREASED MECHANICAL ADVANTAGE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a divisional of U.S. application Ser. No. 13/768,110, filed on Feb. 15, 2013, entitled, "FLUID DISPENSERS WITH INCREASED MECHANICAL ADVANTAGE," which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The disclosure relates to fluid dispensers.

BACKGROUND

Hand washing is important in many industries, including hospitality (hotels, restaurants, etc.) and healthcare (hospitals, nursing homes, etc.). In addition, there are many other applications in which the dispensing of various fluids occurs. To facilitate hand washing, for example, fluid dispensers that dispense hand cleansing products may be placed near sinks of a kitchen, washroom, or other location. Such fluid dispensers house a disposable or refillable product container, such as a cartridge or flexible bag, containing a supply of the fluid product to be dispensed. The fluid may include, for example, foams, liquids, and/or gels. The dispensers are generally wall mounted and include a hinged cover which permits opening and closing of the dispenser housing so that the supply of fluid product may be refilled or replaced. Some fluid dispensers are manually actuated by pushing or pulling a handle, bar, or button on the dispenser. Others dispense automatically by sensing presence of a user or the user's hands near the dispenser.

SUMMARY

In general the disclosure is directed to fluid dispensers and fluid dispense mechanisms providing increased mechanical advantage as the dispense mechanism is moved throughout its range of motion.

In one example, the disclosure is directed to a dispenser comprising a housing, a reservoir positioned in the housing that contains a supply of a fluid to be dispensed, and a dispense mechanism configured to dispense a discrete quantity of the fluid from the reservoir, the dispense mechanism comprising a lever member having a first lever section accessible on an exterior side of the housing, a second lever section, and a fulcrum connected between the first lever section and the second lever section, the fulcrum pivotally supported within the housing such that the lever member is moveable between a rest position and a dispense position upon application of an input force to the first lever section, wherein movement of the lever member between the rest position and the dispense position results in application of an output force by the second lever section, and an actuator configured to receive application of the output force from the second lever section, a pump configured to receive the output force from the actuator and apply a corresponding dispensing force to the reservoir to dispense the discrete quantity of fluid from the reservoir, the second lever section configured to provide at least two contacts points with the actuator as the lever member is moved from the rest position to the dispense position, the second lever section comprising a base segment connected to the fulcrum and providing a first contact point with the actuator and a branch segment connected distally adjacent to the base segment and providing a second contact points with the actuator, the base segment having a thickness that is relatively greater than a thickness of the branch segment, such that a mechanical advantage provided at the first contact point is relatively greater than a mechanical advantage provided at a second contact point, such that an output force applied to the actuator at the first contact point is relatively greater than an output force applied to the actuator at the second contact point.

The drive length of the first contact point may be relatively shorter than a drive length provided by the second contact point. The base segment of the second lever section may apply the output force to the actuator during a first portion of a dispensing stroke and the branch segment of the second lever section may apply the output force to the actuator during a second portion of the dispensing stroke. The fluid product may comprise one of a liquid, a gel, or a foam. The lever member may comprise one of a push bar, a push button, or a handle.

The details of one or more examples are set forth in the accompanying drawings and the description below. Other features and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1**A is a perspective view of an example fluid dispenser that provides increased mechanical advantage.

FIG. **1**B is a front perspective view of the example fluid dispenser of FIG. **1**A with the cover removed.

FIG. **1**C is a front perspective view of the example fluid dispenser of FIGS. **1**A and **1**B) with the cover and the push bar removed.

FIGS. **2**A and **2**B are simplified perspective views of an example prior art dispense mechanism for a fluid dispenser.

FIGS. **3**A-**3**C show simplified side views of an example dispense mechanism in accordance with the present disclosure.

FIG. **4** shows a simplified side view of another example dispense mechanism in accordance with the present disclosure.

FIGS. **5**A and **5**B show simplified side views of another example dispense mechanism in accordance with the present disclosure.

FIGS. **6**A-**6**C show simplified side views of another example dispense mechanism in accordance with the present disclosure.

DETAILED DESCRIPTION

In general the disclosure is directed to fluid dispensers and fluid dispense mechanisms providing increased mechanical advantage as the dispense mechanism is moved throughout its range of motion. Dispensing of fluid products, such as liquids, gels, foams, etc., is becoming increasingly difficult due to the demand for fluid products having increased concentration, thickness, and quality. These product properties result in a product that is more difficult to dispense, and thus require more force to actuate the dispensing pump. However, dispenser manufacturers must at the same time comply with the Americans with Disabilities Act (ADA), which states that the force required to activate the controls of a hand soap dispenser in places of public accommodation or commercial facilities shall be no greater than 5 lbf (pounds of force).

FIG. **1**A is a front perspective view of an example fluid dispenser **100** that provides increased mechanical advantage

in accordance with the present disclosure. FIG. **1**B is a front perspective view of the example fluid dispenser **100** of FIG. **1**A with the cover removed. FIG. **1**C is a front perspective view of the example fluid dispenser **100** of FIGS. **1**A and **1**B) with both the cover and the push bar removed.

Example dispenser **100** includes a housing **110** having a front cover **102** and a back plate **104**. A reservoir **112** (see FIGS. **1**B and **1**C) located within the interior of the housing **110** contains a supply of the fluid to be dispensed. Back plate **104** facilitates mounting of dispenser **100** to a wall or other object. In this example, housing **110** may include a hinge or hinges which permit cover **102** to pivot between a closed position and an open position. A button or latch **106** may be depressed to unlatch cover **102**, thus permitting cover **102** to be opened and closed. A lever member **120**, in this example a so-called push bar, manually operable by a user, is externally accessible on the outside of dispenser housing **110**. Push bar **120** forms a part of a dispense mechanism, the other portions of which are physically located within the interior of housing **110** when the dispenser is fully assembled and the cover is closed, as shown in FIGS. **1**B and **1**C. Although for purposes of illustration the concepts of the present disclosure are generally described herein with reference to a push bar as the user actuatable lever member, it shall be understood that any other type of manually actuatable component, such as a push button, push or pull handle, or other type of lever configuration, may be substituted for the push bar, and that the disclosure is not limited in this respect.

As shown in FIGS. **1**B and **1**C, push bar **120** further includes a hinge **118**. To incorporate push bar **120** into dispenser **100**, hinge **118** may be pivotally mounted to the inside of the dispenser housing **110** or otherwise pivotally supported within the dispenser **100**. Push bar **120**, when depressed by a user, pivots around hinge **118** through a range of motion from a rest position to a dispense position. In this example, the rest position is the position of the push bar when no force is applied and the dispense position is the fully depressed position at which a metered dose of fluid is dispensed.

In addition to push bar **120**, the dispense mechanism of dispenser **100** further includes an actuator **116**. Application of an input force to push bar **120** results in a corresponding application of an output force to actuator **116**. In response to application of the output force, actuator mechanically activates a pump **114** resulting in dispensation of the discrete quantity of the fluid **108** from reservoir **112**.

FIGS. **2**A and **2**B are simplified views of an example prior art dispense mechanism **150** for a fluid dispenser. Housing **110**, back plate **104**, etc. are not shown for purposes of illustration. Dispense mechanism **150** includes a push bar **151**, an actuator **156**, and a pump **158**. Push bar **151** generally operates in accordance with the principles of a lever. Push bar **151** includes a first lever section **152** and a second lever section **154** which pivot about an axis of rotation or fulcrum provided by a hinge or other pivot point **157**. Hinge **157** may be substantially fixedly received into corresponding recesses or other attachment points located within the interior side of the dispenser housing. Application of an input force by a user to first lever section **152** in the direction indicated by arrow **162** causes push bar **151** to pivot on the axis provided by hinge **157**. This results in a corresponding rotational movement of second lever section **154** and application of an output force to actuator **156**, and thus to pump **158**, in the direction of arrow **164**. The output force applied to the lower surface of actuator **156** by the push bar in FIGS. **2**A and **2**B is focused at one contact point; namely, the distal end **160** of second lever section **154**.

The ratio of the output force (F_B) to the input force (F_A), or mechanical advantage (MA), may be used as a measure of the force amplification of a lever. The concept of mechanical advantage may be applied to a push bar of a fluid dispenser, such as push bar **150** shown in FIGS. **2**A and **2**B. For example, the MA of push bar **151** may be expressed in terms of the input force, F_A, applied to the first lever section as indicated by arrow **162** and the output force, F_B, applied by the second lever section **154** to the actuator **156**, as indicated by arrow **164**. This ratio in turn is proportional to the ratio of the length, a, of the first lever section **152** and the length, b, of the second lever section **154** from a fulcrum or hinge **157**:

$$MA = \frac{F_B}{F_A} = \frac{a}{b}.$$

In this example, the output force F_B and thus the mechanical advantage provided by the push bar in FIGS. **2**A and **2**B is focused at one contact point; namely, the distal end **160** of second lever section **154**. Thus, the length of the second lever section **154** for purposes of calculating the mechanical advantage in this example is equal to the total length b of the second lever section **154**.

FIGS. **3**A-**3**C show simplified side views of an example dispense mechanism **201** in accordance with the present disclosure. Dispense mechanism **201** includes a push bar **200**, an actuator **210**, and a pump **208**. Push bar **200** includes a first lever section **202**, a second lever section **204**, and a hinge **206**. First lever section **202** has a total length, a, and second lever section **204** has a total length, b. Actuator **210** is configured to allow for two points of contact with push bar **200**. To that end, example actuator **210** includes a first contact surface **212** configured to contact second lever section **204** at a first contact point and a second contact surface **214** configured to contact second lever **204** section at a second contact point. The first contact point is indicated generally by reference numeral **215** and is located somewhere between the hinge **206** and the distal end **216** of second lever section **204**. The second contact point is generally indicated by reference numeral **217** and is located at the distal end **216** of second lever section **204** in this example.

In operation, application of a force by a user to first lever section **202** in a direction generally indicated by arrow **203** causes push bar **200** to pivot on the axis provided by hinge **206**. As shown in FIG. **3**B, second lever section **204** first contacts and applies a force to first contact surface **212** at first contact point **215** located between hinge **206** and distal end **216** of second lever section **204**. The distance between contact point **215** and hinge **206** is indicated by a length c. The drive length of the lever section to which the input force is applied at the beginning of dispenser operation is thus approximately equivalent to the distance c. It shall be understood that the distance c will vary somewhat as the push bar rotates about hinge **206**; however, the drive length c will always be relatively shorter than the total length b of the section lever section **204** in this example.

Referring now to FIG. **3**C, as push bar **200** continues to rotate about hinge **206**, the second contact point **217** at distal end **216** of second lever section **204** contacts second contact surface **214** of actuator **210**. The drive length of the lever section to which the input force is applied thus transitions from the relatively short drive length c to a relatively longer relative drive length given by b.

The mechanical advantage provided by the relatively shorter drive length, MA_{short}, in this example may be defined by:

$$MA_{short} = \frac{a}{c} = \frac{F_C}{F_A}$$

The mechanical advantage provided by the relatively longer drive length, MA_{long}, in this example may be defined by:

$$MA_{long} = \frac{a}{b} = \frac{F_B}{F_A}$$

Because push bar **200** first contacts actuator **210** with the short drive length, c, the mechanical advantage applied at the beginning of the dispenser operation is relatively higher than the mechanical advantage applied toward the end of the dispenser operation. This allows the pump to start dispensing with a relatively smaller amount of input force required from the user.

As push bar **200** rotates about hinge **206**, actuator **210** is contacted by long drive length, b, and the MA is decreased as compared to the short drive length, c. In addition, the longer drive length defined by the length b reduces the angle, indicated by reference numeral **207**, through which push bar **200** must travel to completely depress the pump. This may help to keep push bar **202** clear of the discharge spray **218**, as shown in FIG. **3**C. If only the short drive length c were used then the push bar may interfere with the pump spray, because the degree of rotation required to fully depress the push bar and to fully dispense the product may be increased.

FIG. **4** shows a simplified side view of another example dispense mechanism **221** in accordance with the present disclosure. Dispense mechanism **221** includes a push bar **220**, an actuator **230** and a pump **235** in accordance with the present disclosure. Push bar **220** includes a first lever section **222**, a second lever section **224** and a hinge **226**. First lever section **222** has a total length, a, and second lever section **224** has a total length, b. In this example, actuator **230** is configured to have three contact surfaces; a first contact surface **232**, a second contact surface **234**, and a third contact surface **236**. In operation, second lever section **234** contacts first contact surface **222**, second contact surface **224**, and third contact surface **226** at drive lengths d, c, and b, respectively, throughout the rotation of push bar **220**. Thus, as the push bar is moved through its range of motion, the mechanical advantage provided upon initial application of a dispensing force (MA_d provided by drive length d at contact surface **232**) is relatively larger than that provided during the middle of the stroke (MA_c provided by drive length c at contact surface **234**), which itself is relatively larger than that provided toward the end of the stroke (MA_b provided by drive length b at contact surface **236**). This relationship may be expressed by the following equation:

$$MA_d \geq MA_c \geq MA_b.$$

FIGS. **5**A and **5**B show simplified side views of another example dispense mechanism **241** in accordance with the present disclosure. Dispense mechanism **241** includes a push bar **240**, an actuator **250** and a pump **251** in accordance with the present disclosure. Push bar **240** includes a first lever section **242**, a second lever section **244** and a hinge **246**. In this example, actuator **240** includes a curved contact surface **252**. As push bar **240** rotates through its range of motion, surface **252** provides a continuously varying point of contact with the second lever section **244**. The point of contact varies between a first contact point **243** at a drive length c located between hinge **246** and distal end **248** of second lever section **244** and a second contact point **245** at a drive length b located at the distal end of second lever section **244**. Curved contact surface **252** may provide a smooth transition of contact along at least a portion of second lever section **244** of push bar **240**, which may help provide a smoother user experience during operation of the dispenser. The angle of rotation **247** at full depression of push bar **240** is sufficiently small to avoid interference with fluid discharge stream **249**.

Because push bar **240** first contacts actuator **250** with the short drive length, c, the mechanical advantage applied at the beginning of the dispenser operation is relatively higher than the mechanical advantage applied toward the end of the dispenser operation, when push bar **240** is contacting actuator **250** with the relatively longer drive length b.

FIGS. **6**A-**6**C show simplified side views of another example dispense mechanism **261** in accordance with the present disclosure. Dispense mechanism **261** includes a push bar **260**, an actuator **270**, and a pump **280** in accordance with the present disclosure. In this example, push bar **260** is configured to provide two points of contact with actuator **270**. Push bar **260** includes a first lever section **262**, a second lever section **264**, and a hinge **266** connected between the first lever section **262** and the second lever section **264**. Actuator **270** includes a contact surface **272**. Second lever section **264** includes a base segment **292** connected to the hinge **266** and providing a first contact point **265** and a branch segment **294** connected distally adjacent to the base segment **292** and providing a second contact point **267**. In this example, to provide for multiple contact points, base segment **292** and branch segment **294** are of differing thicknesses to provide first and second contact points **265** and **267**, respectively. In this example, the thickness, i, of base segment **292** is relatively greater than the thickness, j, of branch segment **294**.

In operation, second lever section **264** first applies an output force upon contact surface **272** at the relatively shorter drive length c. Then, as the rotation of push bar **260** continues, application of the force transitions to the relatively longer drive length b. Thus, as push bar **260** is moved through its range of motion, the mechanical advantage provided upon initial application of a dispensing force (MA_c provided by drive length c by contact point **265**) is relatively larger than the mechanical advantage provided during the latter portion of the stroke (MA_b provided by drive length b by contact point **267**). This relationship may be expressed by the following equation:

$$MA_c \geq MA_b.$$

Because push bar **260** first contacts actuator **270** with the short drive length, c, the mechanical advantage applied at the beginning of the dispenser operation is relatively higher than the mechanical advantage applied during the latter portion of the dispenser operation, when push bar **260** is contacting actuator **270** with the relatively longer drive length b.

Alternatively, push bar **260** may be configured to provide multiple points of contact. For example, second lever section **264** may include a base segment, such as base segment **292**, connected to hinge **266** and providing a first contact point **265**. Second lever section **264** may further include one or more branch segments connected distally adjacent to the base segment **261** and providing a corresponding one or more contact points. In this example, to provide for multiple contact points, the base segment and each of the one or more

branch segments may have differing thicknesses to provide the multiple contact points. For example, each branch segment may have a relatively smaller thickness than the proximally adjacent branch segment.

Although specific example fluid dispensers are shown and described herein that provide for multiple points of contact during dispenser operation, it shall be understood that many other variations of the fluid dispensing mechanism may also be used without departing from the spirit and scope of the present disclosure. For example, the actuator and/or the push bar may be configured in a variety of different ways to provide for multiple points of contact during actuation of the dispenser. For example, an actuator may be configured to include any desired number of contact surfaces to provide multiple points of contact with a push bar, thus providing a corresponding number of different drive lengths throughout the range of motion of the push bar. In addition or in the alternative, a push bar may be configured to include any desired number of contact points to provide multiple points of contact with an actuator throughout its range of motion. As another example, both the actuator and the push bar may be configured to provide multiple points of contact corresponding to a different number of drive lengths through the range of motion of the push bar. It shall be understood, therefore, that the disclosure is not limited to the specific examples shown and described herein, that many other variations of actuator and/or push bar configurations may be used, and that the disclosure is not limited in this respect.

Various examples have been described. These and other examples are within the scope of the following claims.

The invention claimed is:

1. A dispenser comprising:

a housing;

a reservoir positioned in the housing that contains a supply of a fluid to be dispensed; and

a dispense mechanism configured to dispense a discrete quantity of the fluid from the reservoir, the dispense mechanism comprising:

a lever member having a first lever section accessible on an exterior side of the housing, a second lever section, and a fulcrum connected between the first lever section and the second lever section, the fulcrum pivotally supported within the housing such that the lever member is moveable between a rest position and a dispense position upon application of an input force to the first lever section, wherein movement of the lever member between the rest position and the dispense position results in application of an output force by the second lever section; and

an actuator configured to receive application of the output force from the second lever section;

a pump configured to receive the output force from the actuator and apply a corresponding dispensing force to the reservoir to dispense the discrete quantity of fluid from the reservoir,

the second lever section configured to provide at least two contacts points with the actuator as the lever member is moved from the rest position to the dispense position, the second lever section comprising a base segment connected to the fulcrum and providing a first contact point with the actuator and a branch segment connected distally adjacent to the base segment and providing a second contact points with the actuator, the base segment having a thickness that is relatively greater than a thickness of the branch segment, such that a mechanical advantage provided at the first contact point is relatively greater than a mechanical advantage provided at a second contact point, such that an output force applied to the actuator at the first contact point is relatively greater than an output force applied to the actuator at the second contact point.

2. The dispenser of claim **1** wherein a drive length of the first contact point is relatively shorter than a drive length provided by the second contact point.

3. The dispenser of claim **1** wherein the base segment of the second lever section applies the output force to the actuator during a first portion of a dispensing stroke and the branch segment of the second lever section applies the output force to the actuator during a second portion of the dispensing stroke.

4. The dispenser of claim **1** wherein the fluid product comprises one of a liquid, a gel, or a foam.

5. The dispenser of claim **1** wherein the lever member comprises one of a push bar, a push button, or a handle.

6. The dispenser of claim **1** wherein the base segment of the second lever section has a drive length c, the branch segment of the second lever section has a drive length b which is relatively longer than the drive length c of the base segment.

7. The dispenser of claim **6** wherein a relationship between a mechanical advantage, MA_c, provided by the base segment and a mechanical advantage, MA_c, provided by the branch segment is:

$$MA_c \geq MA_b.$$

8. The dispenser of claim **1** wherein the relatively greater mechanical advantage is provided during a first portion of a dispensing stroke.

9. The dispenser of claim **1** wherein the input force is no greater than 5 pounds of force (lbf).

10. The dispenser of claim **1** wherein the actuator, in response to application of the output force, mechanically activates the pump resulting in dispensation of the discrete quantity of the fluid from the reservoir.

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